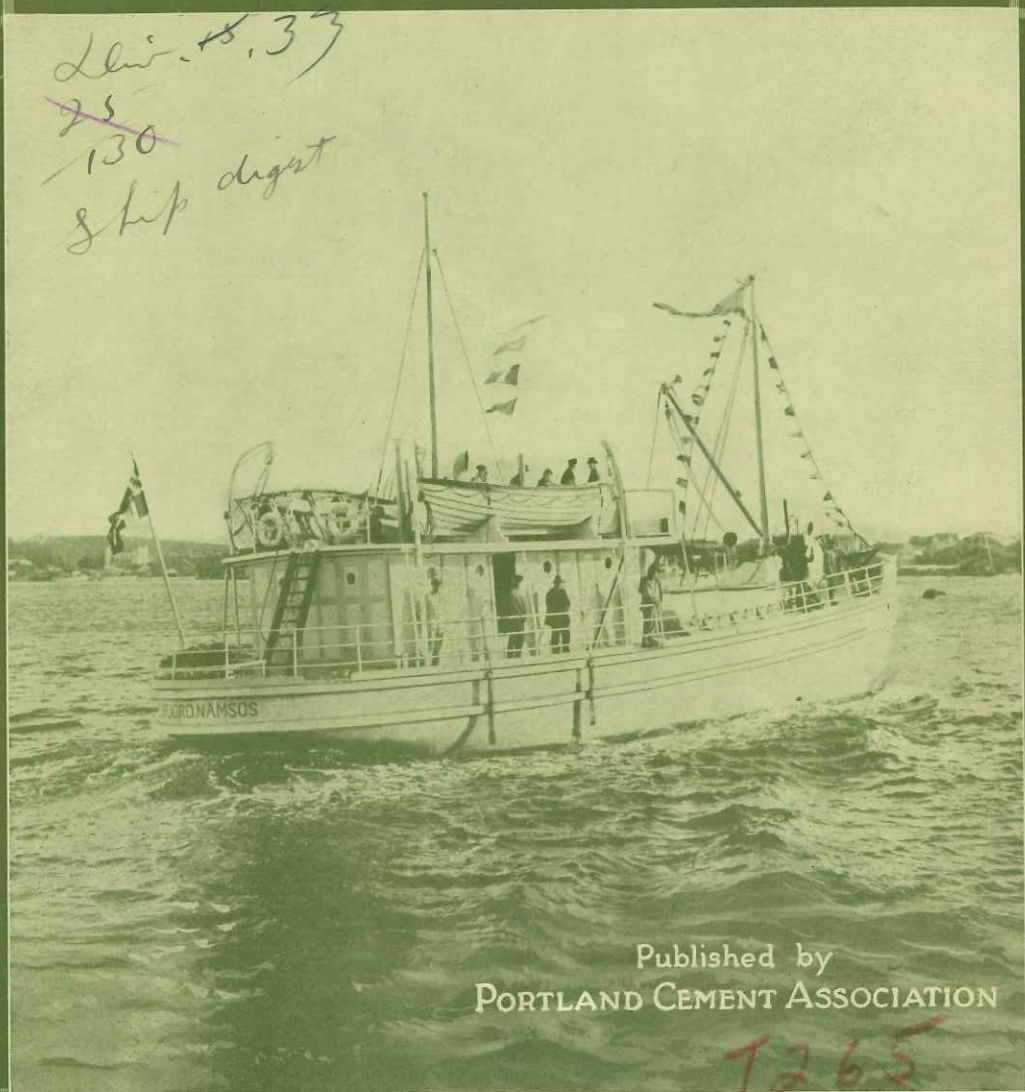
PROGRESS *in* CONCRETE SHIP CONSTRUCTION



Published by
PORTLAND CEMENT ASSOCIATION

Herbert Kaufman on Concrete Ships

(The following is taken from one of Herbert Kaufman's weekly articles entitled "Dwarfs and Giants." Mr. Kaufman regards the practicability of concrete ships no more questionable than was the sewing machine, the cotton gin, the telephone, wireless telegraphy or any other one of those things which just couldn't be done but has long since become a reality. Mr. Kaufman's articles are prepared for and appear first in the Hearst daily papers and monthly magazines.)

If such ingenuities and benefactions as managed to prevail over obdurate yesterdays had been submitted to a general vote for acceptance, there wouldn't be a cog-wheel, a smoke-stack, a scalpel, a crucible or a weaving frame in existence.

The initial verdict on the sewing machine and the cotton gin, Bell's "talking toy" and Marconi's "crazy scheme," sulphur mining by live steam and the practicability of *concrete ships*, was a deriding "haw-haw."

You can't point to a single minute-saving, space-squeezing, waste-checking, disease-preventing, race-ennobling proposition now in universal employ that didn't wear the fool's cap for a while.

You can't mention a solitary mortal who signally uplifted his generation without suffering from the audacity.

You can't produce from the patent office files one ultimately celebrated innovation that didn't beat on countless doors before it found credulous capital.

We have advanced in spite of preponderating asses and reactionaries. It consoles numskulls and quitters to decide that achievements beyond personal capacity and patience are ridiculous.

So hold to your courageous ambitions. Never surrender a sincere conviction — never abandon a unique theory — never re-draft the specifications of a great promotion because the shallow crowd-injury is against you.

A million dwarfs of identical stature can't together look as high as one giant; a million men in a canyon can't see as far as a single man on the heights.

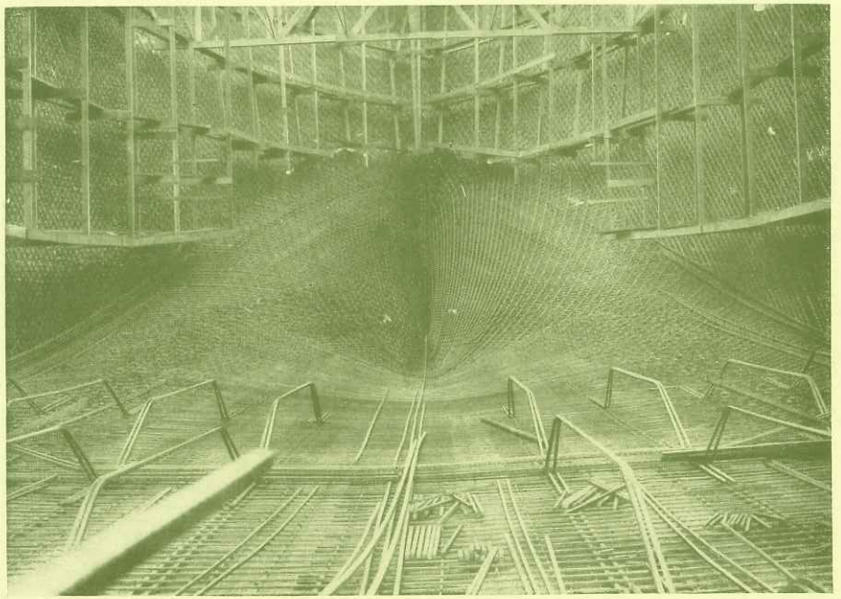
PROGRESS IN CONCRETE SHIP CONSTRUCTION

SHIPS! SHIPS! SHIPS!

In *Collier's*, of March 2, 1918, Mark Sullivan, editor, in the leading article entitled "Wake Up!" says:

> **"We should build ships and ships and ships. And then we should build faster ships. And after that we should build more ships. We should build steel ships and wooden ships and concrete ships and composite ships. We should build anything that will float. If it is not adapted to defense against the submarine, we can use it to bring manganese from Brazil and rubber from Ceylon."**

For months the press has been in accord that no situation which we have had to confront since our entrance into the world's war has been more serious than that of adequate marine transportation. And so far



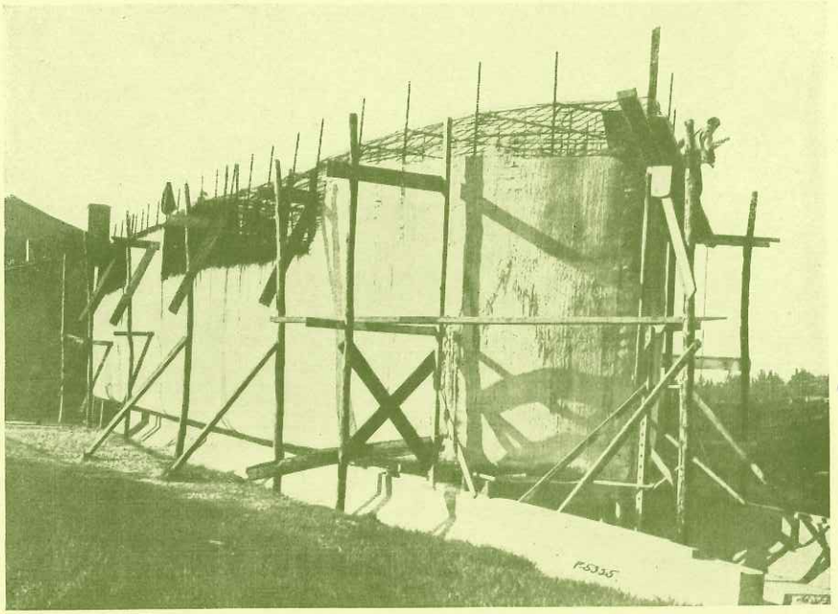
View inside of the 5000-ton reinforced concrete ship at Redwood City, Cal., showing fabrication of reinforcement at the bow.

there seems to be a consensus of opinion that instead of being relieved, the situation is daily becoming more acute. Figures which are accredited to the National Committee of Patriotic Societies and which were published in the *Chicago Daily Tribune* of March 1, show that the present acute shortage is at least 7,435,894 gross tons — almost 1,500 vessels of 5,000 gross tons each. There is no way to get the food and supplies to our men who are fighting

our battles abroad except by ships, and we can bridge the Atlantic successfully only if we build enough ships.

CONCRETE SHIPS MAY HELP TO SPEED UP THE SHIP BUILDING PROGRAM

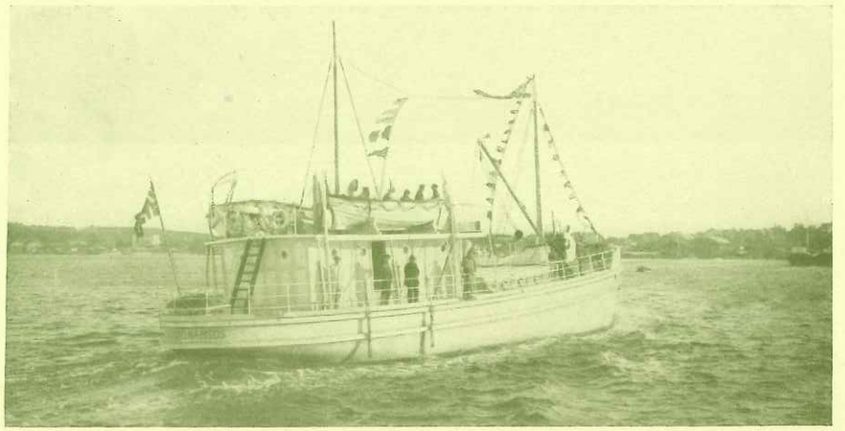
In July, 1917, and again in December of the same year, the Portland Cement Association issued in booklet form, compilations of data intended to show what had been accomplished in the use of concrete in building



One of the concrete boats which France is building at Bordeaux. In this view the sides of the vessel have been carried up to a point near the reinforcement already placed for the deck.

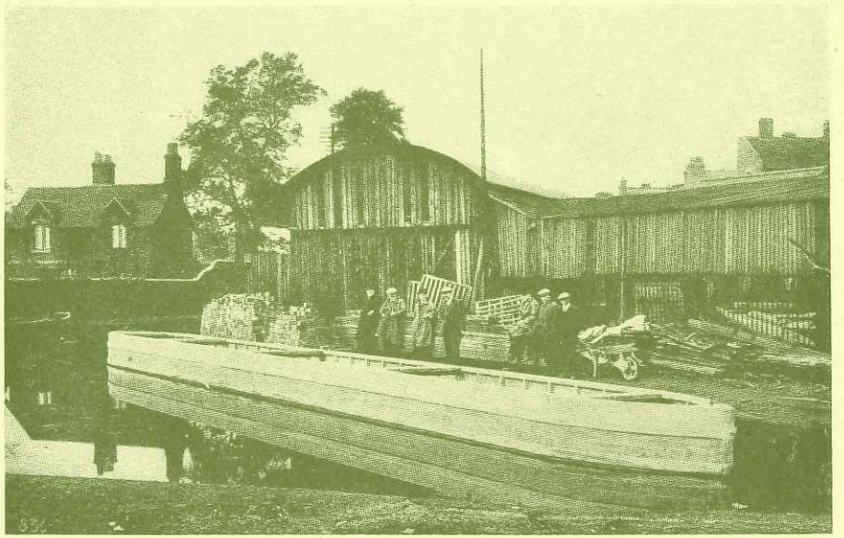
ships, lighters and barges. The present booklet, "Progress in Concrete Ship Construction," is a compilation of such data as have been made available by further applications of concrete in attempting to solve the shipping problem since the December, 1917, booklet was issued. In that booklet mention was made of concrete shipbuilding activities in Norway, and illustrations presented of the 400-ton concrete motorship, Namsenfjord, built by the Fougner Steel Concrete Shipbuilding Co., of Moss, Norway. Although this motorship was then afloat and in commission, it had not been recognized as an oceangoing vessel. About the middle of January, however, various papers carried items describing an accomplishment of the Namsenfjord, which is well summed up in the following, that appeared in *The Contract Record* (Toronto), January 16, 1918:

"The first concrete ship has made a round trip and sailed into its home port, after a successful voyage. It is a Norwegian vessel, called the Namsenfjord, and has just returned from the British Isles, after having steamed two thousand miles. This ship



Motorship "Namsenfjord" on trial trip. The 80 horsepower oil-burning motor with which she is equipped gives the vessel a speed of 7½ miles per hour when fully laden.

was built several months ago, and is made of structural steel and concrete. It is said to have answered every test satisfactorily, unaffected by the vibration of the engines and withstanding the jamming which a ship frequently receives when it is docked.

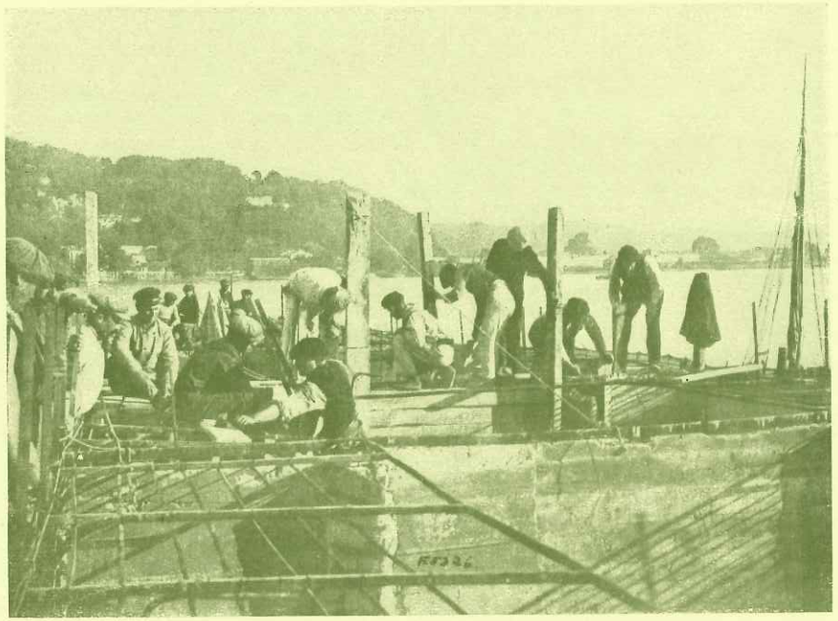


Reinforced concrete barge built for and in use on one of the English canals.

Also it shows no ill effects caused by contraction and expansion. The vessel is of the single-screw type, driven by a heavy oil engine, and has a displacement of about five hundred tons."

FOUGNER COMPANY ORGANIZED IN THE UNITED STATES

In December, 1917, Nic K. Fougner, of the Fougner Steel Concrete Shipbuilding Co., Moss, Norway, came to the United States, and has



At work on concrete ship construction at a plant where vessels of this kind are now being built at Bordeaux, France. At this port, it is said, the French Government is constructing a huge fleet of concrete ships to help solve the shipping problem.

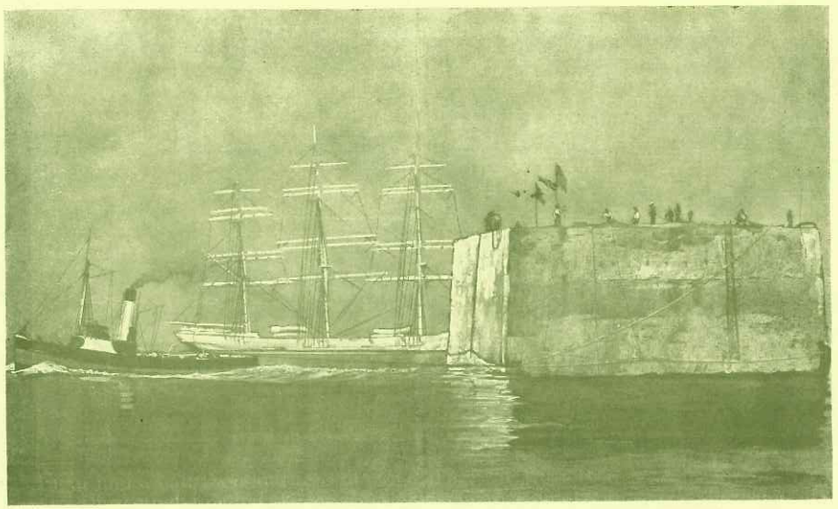
but recently completed the organization of the Fougner American Steel Concrete Shipbuilding Co., of New York.

REPORT OF JOINT COMMITTEE AMERICAN CONCRETE INSTITUTE AND PORTLAND CEMENT ASSOCIATION ON CONCRETE SHIPS

During the summer of 1917 a joint committee of the American Concrete Institute and Portland Cement Association was appointed to undertake an investigation and report upon the practicability of building concrete ships and barges. In December, 1917, this joint committee submitted a report which included interesting data resulting from its investigations as well as several designs.

DESIGN FOR 2000-TON SEAGOING BARGE

A tentative design for a seagoing concrete barge was one of the results of the above committee's investigation. This is of 2,000 tons capacity, the various dimensions being as follows: Length over-all 227 feet 6 inches; length between perpendiculars 220 feet; beam 42 feet; depth 23 feet; loaded draft 18 feet. Displacement was estimated as 3,675 tons on an



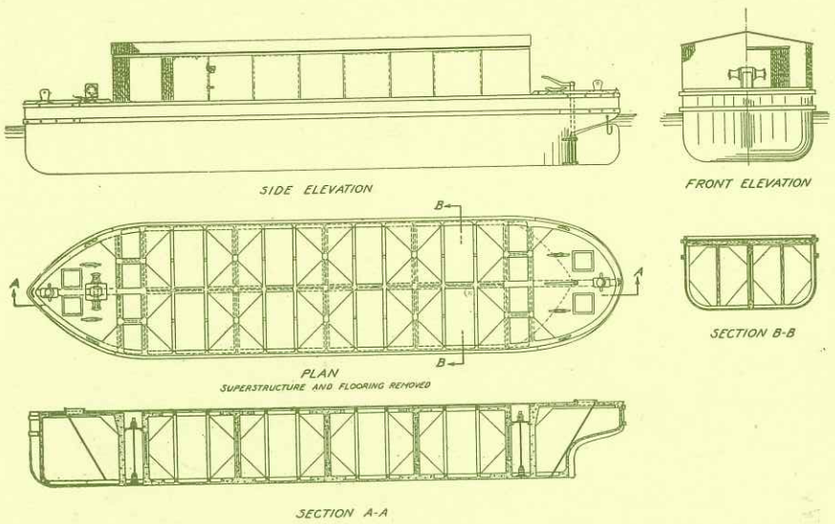
Eight and a half thousand tons of stone afloat. A great British engineering feat. The Illustrated London Times shows this picture of a hollow concrete unit of the Valparaiso breakwater, and remarks that it proves the practicability of concrete for ships. Weighing 8,560 tons, it is floated to its position and sunk.
(Copyright by The Illustrated London Times)

18-foot draft and 3,680 tons on a 19-foot draft. The vessel is divided into five compartments by transverse bulk-heads, the three center compartments being for cargo and the other two for tanks and ballast.

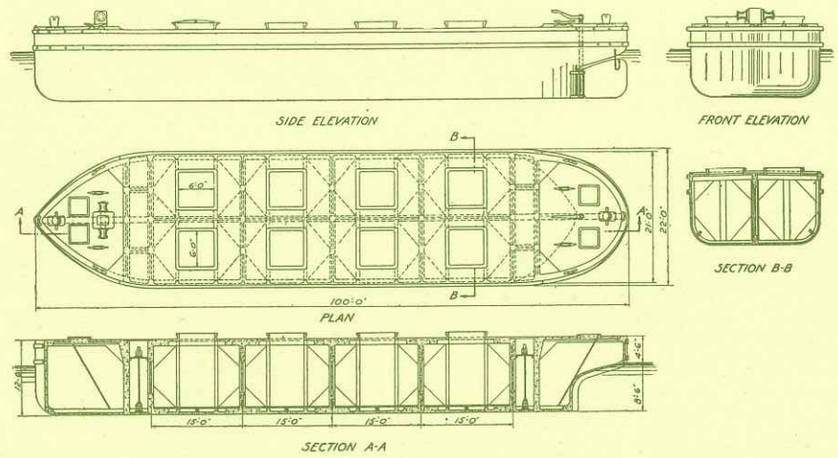
Spacing of frames is 4 feet and thickness of shell 4 inches on the sides and 5 inches on the bottom. Two lines of reinforcement are provided. The deck is 3 inches thick between hatches and along the lines of the hatches, and 5 inches thick outside these lines. An estimate of quantities gave the following:

Concrete	731 cubic yards
Steel	482,000 pounds
Flooring for hold	30,000 feet B. M.
Oak timbers for fenders and rail	15,000 feet B. M.

The total weight of ship was estimated as 1,647 tons and the carrying capacity for 18 and 19-foot draft as 2,028 tons and 2,213 tons, respectively.



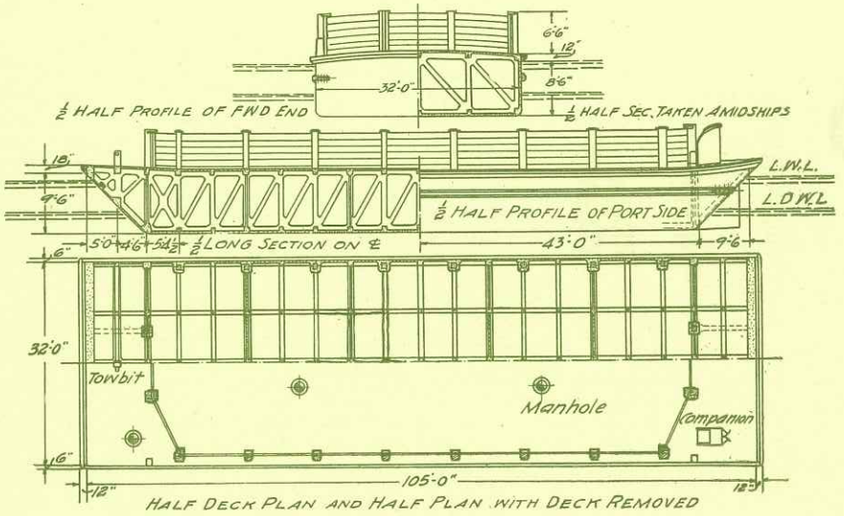
Design for reinforced concrete barge, particularly suitable for deck loading. Capacity from 250 to 300 tons. Designed by the Lord Construction Co., contracting engineers, New York.



Design for reinforced concrete barge intended for loading in the hold and proposed for use in coal and grain traffic between lake ports and tidewater. Designed by the Lord Construction Co., contracting engineers, New York.

Cost per ton deadweight was estimated at $63, while the best available figures as to cost of a steel hull of the same character were from $90 to $120 per ton, and the cost of a wood hull $70 to $100 per ton.

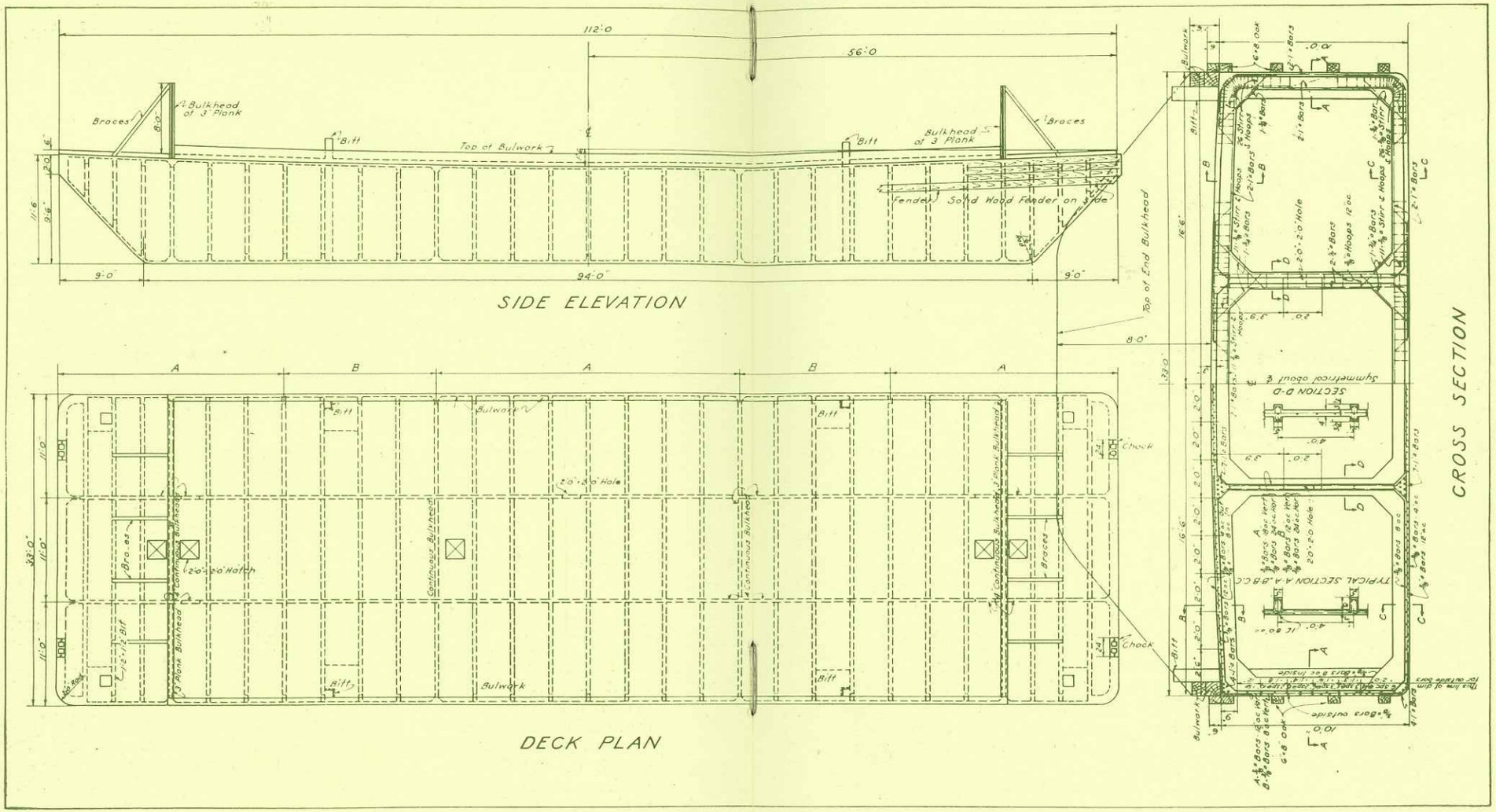
The Portland Cement Association has reprinted the full report of the Joint Committee of the American Concrete Institute and Portland Cement Association, copies of which with designs included can be obtained by those interested, upon request.



General arrangement of 500-ton dead weight reinforced concrete scow designed by Taylor Engineering Co., Ltd., Vancouver, B. C.

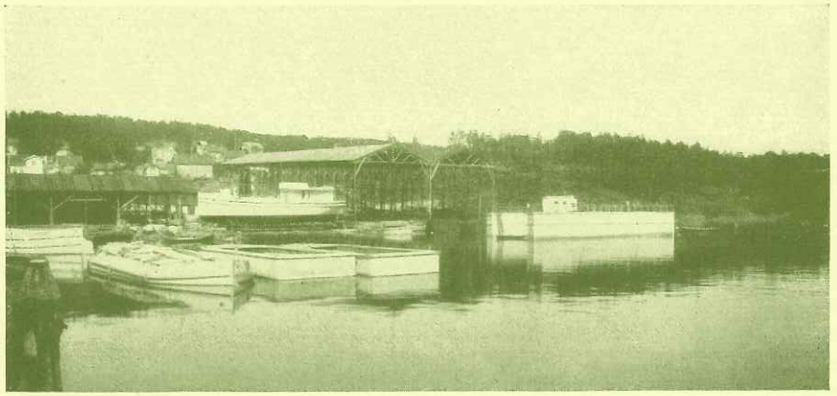
The Lord Construction Co., contracting engineers, 105 West 40th Street, New York, has prepared designs for two types of reinforced concrete barges. One type is particularly suitable for deck loading, thus making it of special use in canal traffic to handle package freight. The other type is designed for loading in the hold and is intended for handling coal and grain from lake ports to tidewater. Both of these types have been planned with particular reference to use on the Great Lakes and Erie Canal. F. W. Erickson, Chief Engineer of the Lord Construction Co., who has been responsible for the designs mentioned, says that it is expected 100 of these two types of barges will be ready for use on the Erie Canal by the opening of navigation in May, 1918. Their capacity is from 250 to 300 tons.

The Taylor Engineering Co., Ltd., Vancouver, B. C., consulting and constructing engineers, have designed a 1,200-ton well deck barge, intended for coal carrying. They have also designed smaller barges; details of two of 500-ton capacity are shown elsewhere.



Design for reinforced concrete deck barge, 465 tons dead weight, at 8-foot 6-inch draft. Prepared by Robert W. Boyd, Consulting Engineer, New York, for the Joint Committee on Concrete Ships and Barges of the American Concrete Institute and Portland Cement Association. Blueprints of this design, size approximately 24 by 36 inches, showing details and dimensions clearly, may be had free of charge by those interested upon request to the Portland Cement Association.

Work is progressing on the 5,000-ton concrete vessel that was started last year at Redwood City, Cal. The magnitude of this undertaking developed various problems from day to day that have been responsible for some delay, but progress has been such that it is likely the largest concrete ship so far actually attempted will soon be afloat.



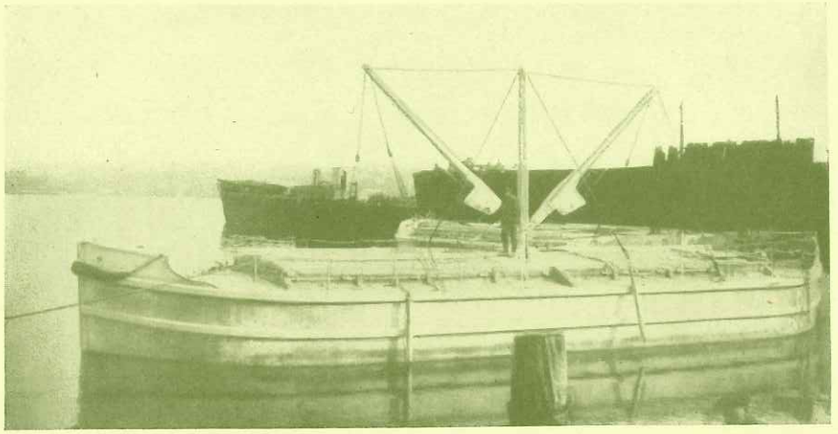
Plant of Fougner Steel Concrete Shipbuilding Co., at Moss, Norway. Concrete barges, a motorship and a floating dry dock are shown.

PROGRESS IN CONCRETE SHIPBUILDING ABROAD

ENGLAND

V. Elmont, formerly consulting concrete engineer, Chicago, and now of 35 Gloucester Gardens, Hyde Park, England, on January 5, 1918, wrote the Portland Cement Association that he had recently gone into reinforced concrete shipbuilding, having designed a number of barges and seagoing vessels, for which the highest classification of the registration societies has been obtained. Mr. Elmont says: "I am at present interested in the building of ten 1,000-ton deadweight seagoing reinforced concrete barges which I hope will be finished within a few months' time."

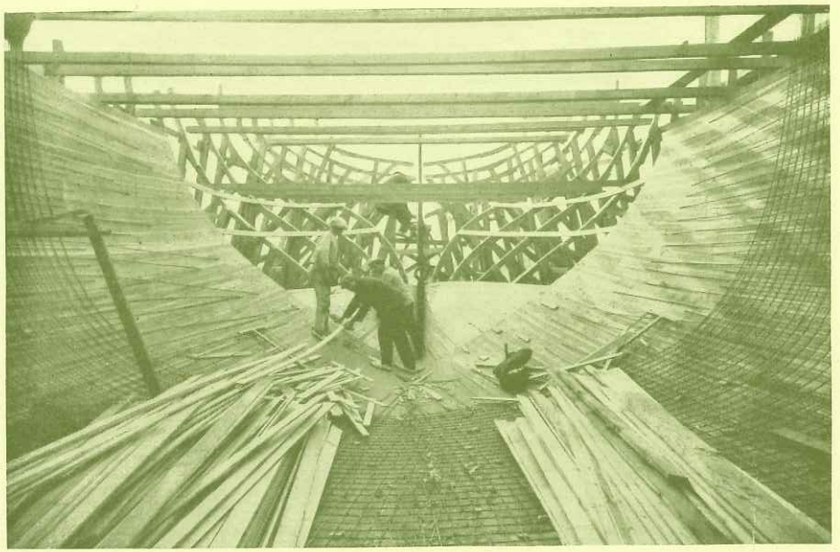
Concrete and Constructional Engineering (London) for December, 1917, contains a number of illustrations and references to concrete shipbuilding now going on in various places in Europe. One illustration is of a reinforced concrete barge that is used in Midland Canal traffic. This was built by A. H. Guest, of Coalbournbrook Wharf, Stourbridge, after a design by E. P. Wells, of 94 Larkhall Rise, London.



One of the Fougner type of 100-ton concrete lighters used by the Norwegian navy.

SPAIN

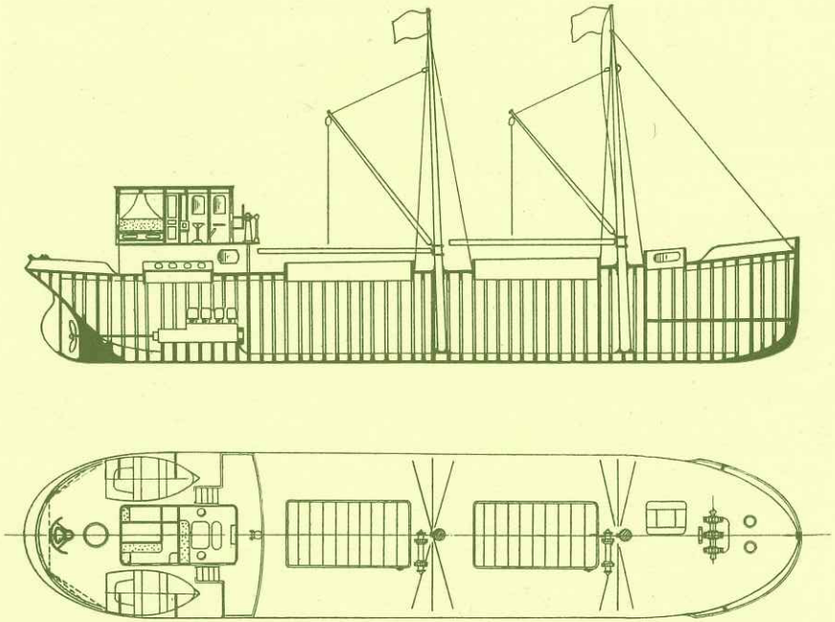
Other illustrations and descriptions in the same issue of *Concrete and Constructional Engineering* refer to the building of a small concrete boat and also to concrete shipbuilding now under way in Barcelona, Spain, by a company known as Construcciones y Pavimentos.



At work on form construction at the stern of one of the reinforced concrete vessels now being built in Barcelona, Spain.

On learning of this work, the Portland Cement Association cabled Construcciones y Pavimentos, Barcelona, for more detailed information and received plans and photographs of work on the first concrete vessel which the company mentioned has undertaken to build. In addition, the following data were supplied:

Plans of this firm for 1918 involve building a gross tonnage of 40,000, which corresponds to a displacement of 70,000. This will be made up of standard types of concrete ships of 300, 500 and 1,000 tons each. The



Sketches showing some features of the type of reinforced concrete vessels being built in Barcelona, Spain.

company has just acquired an additional site with 2,000 meters water front to enable enlarging its plant and plans to provide ways that will permit simultaneous construction of 30 concrete vessels, some of which will be of 6,000 tons capacity. Construcciones y Pavimentos has acquired various patents which it is said will make possible the building of reinforced concrete ships with unusual speed and economy. A sketch showing some details of the concrete boat now being built by this company and photographs of the actual work are reproduced elsewhere in this booklet.

GERMANY

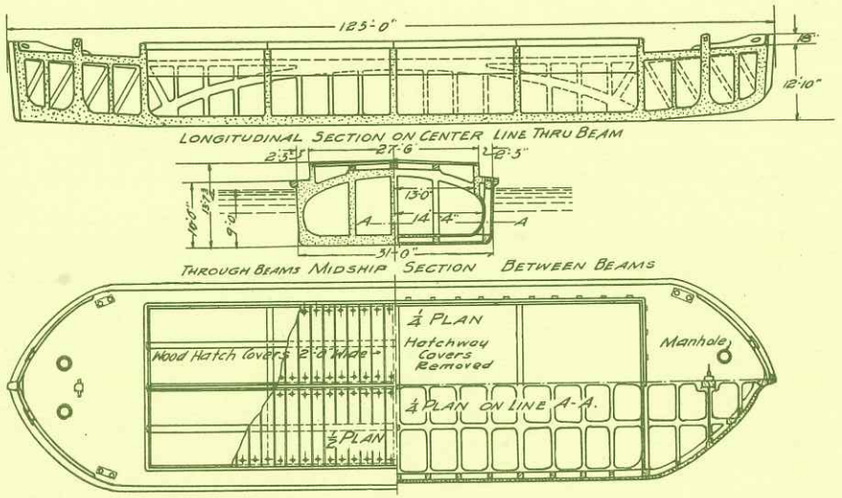
The following appeared in the *New York Times*, February 4, 1918:

CONCRETE SHIPS IN GERMANY

Persius Tells of Plans to Build Them After War

" German shipbuilders have been quick to take up the idea of constructing ships of concrete, according to Captain L. Persius, who writes in the *Berliner Tageblatt* that, owing to prospective shortage of wood, steel and iron for shipbuilding after the war, leading German and Austrian dockyards are preparing to use ferro-concrete on a large scale. Yards are now being reconstructed to that end.

" As told in the London papers, Captain Persius takes the view that all the great shipbuilding countries will be put to the same necessity as Germany to find substitutes



500 TON WELL DECK SCOW

Preliminary design for a reinforced concrete well deck scow, capacity 500 tons, designed by the Taylor Engineering Co., Ltd., Vancouver, B. C.

for wood, iron and steel. Germany, he thinks, will be in better position than any of the rest for ferro-concrete construction, because:

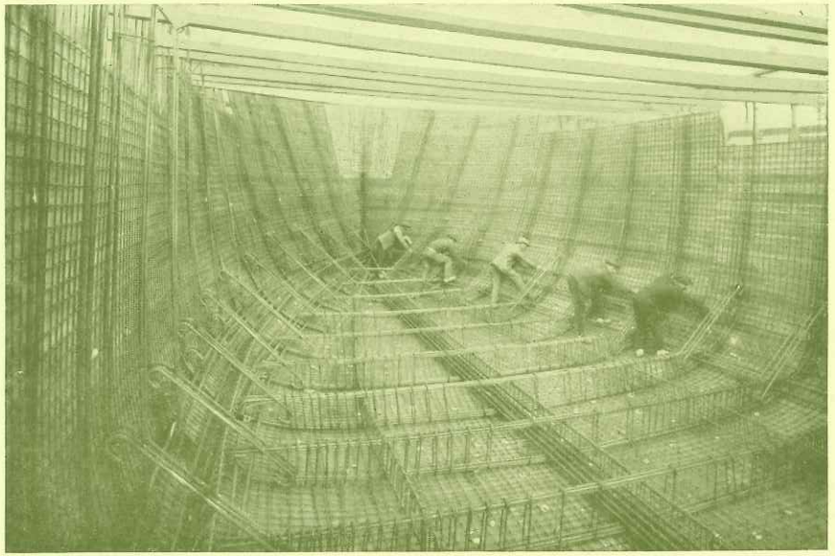
" We possess the most important cement industry in the world. We have far outstripped France, the country where the most versatile uses were formerly made of cement, while we have given the English, the inventors of cement, the fiercest competition in the markets of the world. There seems every reason to hope that in future the largest ships flying the German flag will be partially of ferro-concrete construction."

Shipping (New York) of February 23, 1918, contained the following:

"The firm of Wayss & Freytag A. G., one of the oldest and leading German firms specializing in reinforced concrete, has established a shipbuilding department. The staff heads of the new department will be Fr. W. Achenbach as shipbuilding superintendent, and Dr. Morsch (Professor at the Stuttgart High School) as reinforced concrete expert. The new department will have the advantage of $1,960,000 share capital and of the firm's 42 years' experience in concrete work of all descriptions. Observations and tests have been made concerning the behavior of various floating vessels of reinforced concrete; and concerning the resistance of concrete to sea water, oil, vibration, etc. A number of designs have been developed for simple types of vessels, and these have been offered for criticism and survey in Berlin. A subsidiary company, with a capital of $416,500, has been formed in Budapest to build Danube vessels of reinforced concrete (a 700-ton barge will be built first)."

CONCRETE DRY DOCKS

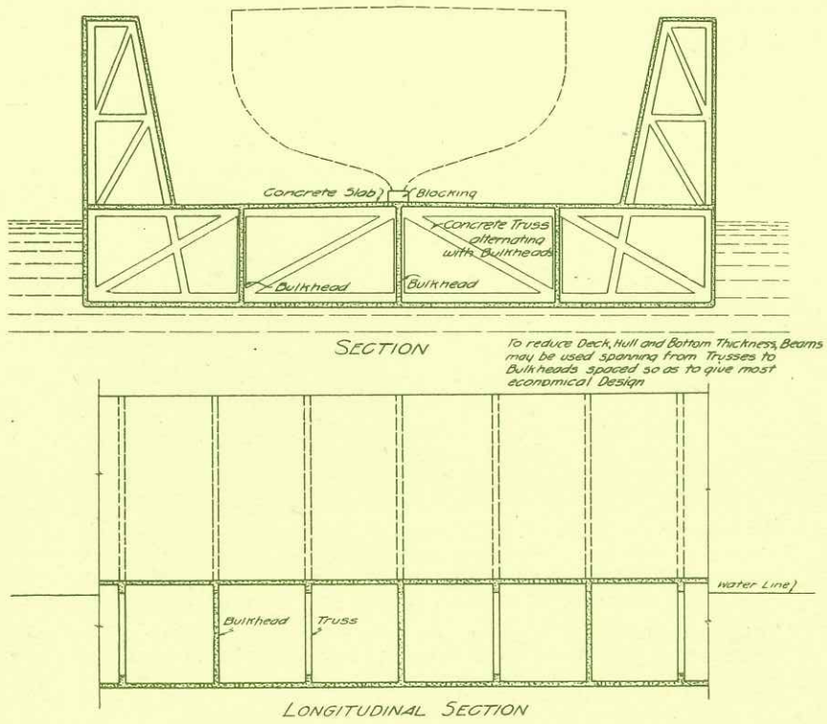
Along with developments in concrete ships has come the development of the floating dry dock of concrete. One such was built during the past year by the Fougner Company at Moss, Norway, and an illustration of it is reproduced in this booklet. This dock, according to the *Scientific American* of January 26, 1918, is 80 feet long by 38 feet wide, outside over-



At work placing reinforcement on a concrete ship being built at Barcelona, Spain.

all dimensions, and from top to bottom it stands 20 feet high. The sill is 4½ feet thick, and the side walls 6½ feet at the bottom; so the dock will accommodate a vessel 75 feet long and of 25 feet beam. It consists of nine

watertight compartments, and is equipped with a centrifugal pump, electrically operated, by means of which it will lift a load of 100 tons out of water in an hour. The reinforcing system is similar to that of the



Suggested plan for reinforced concrete floating dry dock.

Namsenfjord, and characteristic of all the Fougner maritime concrete construction.

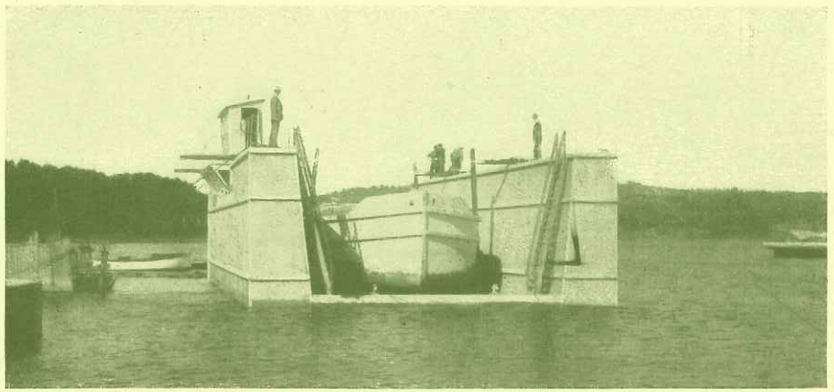
While this dock is a small one, she is so for commercial reasons only. She was ordered by a Christiania firm of yacht builders, who naturally did not require a very spacious chamber. Very much larger docks of the same type are under construction, and contracts are being negotiated for others with lifting power up to 15,000 tons. The first one was made so small, not because it was felt to be in any way an experiment, but simply because that was the size for which a customer had been found. It has been in use by the purchasers for several months, with complete satisfaction.

AN EXPLANATION OF TONNAGE

Perhaps the majority of persons are not familiar with the various definitions of tonnage as used in shipping circles. They are gross tonnage, net registered tonnage, deadweight carrying capacity and displacement.

The *Philadelphia Ledger* of December 23 explained these as follows:

" Gross tonnage is based on the cubic contents of the hull, with certain arbitrary spaces deducted and has little bearing on the cargo-carrying capacity of the vessel.



The first concrete floating dry dock, accommodating boats up to 75 feet long by 25 feet wide and having a lifting capacity of 100 tons. Built and used by the Fougner Steel Concrete Shipbuilding Co., Moss, Norway.

" Net registered tonnage is gross tonnage, with certain allowances for crew space and machinery space deducted, and has little bearing on the deadweight carrying capacity of the vessel.

" Deadweight tonnage is what the vessel actually can carry in tons of heavy cargo, plus stores and bunker coal.

" Displacement is the total weight of the vessel when full of cargo — that is, the weight of her hull plus her deadweight tonnage.

" In round numbers, a ship of 9,000 tons deadweight would stand about as follows:"

Deadweight carrying capacity	9,000
Gross tonnage	5,000
Net registered	3,000
Displacement	12,000

THE Portland Cement Association is endeavoring to collect all information on developments that are taking place in the use of concrete for barges, lighters and ships.

It has also collected names and addresses of firms and individuals engaged or interested in the design and construction of concrete ships and barges.

We shall be glad to place at the disposal of those interested any such information now on hand or that may be collected subsequent to the issue of this booklet.

March, 1918

PORTLAND CEMENT ASSOCIATION

Offices at

ATLANTA
CHICAGO
DALLAS
DENVER
HELENA
INDIANAPOLIS
KANSAS CITY
MILWAUKEE
MINNEAPOLIS
NEW YORK
PARKERSBURG
PITTSBURGH
SALT LAKE CITY
SAN FRANCISCO
SEATTLE
WASHINGTON, D. C.